Eric C. Cyr

CONTACT INFORMATION

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EDUCATION

University of Illinois at Urbana-Champaign, Urbana, Illinois
Ph.D. in Computer Science with a certificate in Computational Science and Engineering,
Graduation: December 2008
Thesis Advisor: Stephen Bond

Clemson University, Clemson, South Carolina
B.S. in Computer Science,
Graduation: December 2002, *Summa Cum Laude*

EXPERIENCE

Sandia National Laboratories, Albuquerque, New Mexico January 2015-Present
Principal Member of the Technical Staff: Computer Science Research Institute
Research area: Preconditioners for multiphysics applications, adjoint-based error estimation, uncertainty quantification, development of high performance finite element software

Sandia National Laboratories, Albuquerque, New Mexico May 2010-January 2015
Senior Member of the Technical Staff: Computer Science Research Institute
Research area: Preconditioners for multiphysics applications, adjoint-based error estimation, uncertainty quantification, development of high performance finite element software

Sandia National Laboratories, Albuquerque, New Mexico Jan. 2009-April 2010
Postdoctoral Researcher: Computer Science Research Institute
Research area: Preconditioners for multiphysics applications

University of Illinois at Urbana-Champaign, Urbana, Illinois Aug. 2003-Dec. 2008
Research Assistant: Department of Computer Science
Research area: Potential of Mean Force Calculations, Poisson-Boltzmann Equation

Clemson University, Clemson, South Carolina Jan. 2003-July 2003
Research Programmer: Center for Advanced Engineering Fibers and Films
Research area: High Performance C++ Software for Non-Newtonian Fluids

Sandia National Laboratories, Albuquerque, New Mexico Summer 2002
Summer Intern: Computer Science Research Institute
Research area: Initial development of "Surfpack" software for surrogate modeling

Schlumberger Industries, West Union, South Carolina May 1999-Dec. 2000
Test Engineering Co-op

PROJECTS

Preconditioners for Multiphysics Applications
Linear systems arising from multiphysics applications are difficult to solve efficiently be-

cause of the complex coupling between the different physics. The purpose of this project is to develop preconditioners for these linear systems. Our approach is to localize the coupling into a Schur complement via a block factorization of the linear operator. Then, the challenge is to approximate the Schur complement in a manner that leads to an effective preconditioner. See [1, 2, 7, 10, 11, 14].

Adjoint-based Sensitivity Analysis and Error Estimation
The solution to PDE systems is often used to estimate specific engineering quantities-of-interest, referred to as "responses". Adjoint-based sensitivity analysis can provide gradients of these responses with respect PDE solution values and parameters. This is useful to understand how the response changes in as a result of small perturbations in the parameters or errors in the solution field. See [4, 5, 6, 9, 12].

Past Projects

Potential of Mean Force
The Potential of Mean Force is the free energy profile computed from a coarse grained description of a (bio)molecular system. This research focuses on numerical methods for computing the profile. Approaches include methods based on solving boundary value problems [16] and approximation of probability density functions using maximum entropy methods.

Poisson-Boltzmann Equation
Simulating a molecule requires accurate representation of the solvent. The electrostatic forces of the solvent on the molecule can be modeled implicitly by a nonlinear PDE known as the Poisson-Boltzmann equation. The purpose of this project is to examine and develop algorithms for discretizing and solving the Poisson-Boltzmann equation, including first order least squares formulations [15], goal oriented adaptive mesh refinement and multigrid methods [12].

Fast Electrostatics with a Smoothly Varying Dielectric
Performed initial study of solving the Poisson equation for the electrostatic potential surrounding a molecular system with a dielectric that varies smoothly around the molecule. This relies on computing the effective charge distribution induced by the dielectric using fast linear time methods.

Generic Programming for Non-Newtonian Viscoelastic Flows
Implemented a finite element code for viscoelastic flows exploiting the generic programming abilities of C++. Investigated fast and modular techniques for implementation of finite elements. The resulting code's run time is competitive with a similar package written in FORTRAN [18].

Surface Fitting Software Package
Under the supervision of Anthony Giunta at Sandia National Laboratories I designed a software package for surface fitting methods. One challenging design requirement was that the interface had to be accessible to both C++ and FORTRAN developers [17].

Publications

Journal Articles & Conference Proceedings

[1] T. R. Benson, J. H. Adler, E. C. Cyr, S. P. MacLachlan, and R. S. Tuminaro, Monolithic

Multigrid Methods for Two-Dimensional Resistive Magnetohydrodynamics, *Submitted to SISC*, 2015.

[2] J. N. Shadid, R. P. Pawlowski, E. C. Cyr, R. S. Tuminaro, L. Chacon, and P. D. Weber, Scalable Implicit Incompressible Resistive MHD with Stabilized FE and Fully-coupled Newton-Krylov-AMG, *Submitted to CMAME*, 2015.

[3] D. Sondak, J. N. Shadid, A. A. Oberai, R. P. Pawlowski, E. C. Cyr, and T. Smith, A new class of finite element variational multiscale turbulence models for incompressible magnetohydrodynamics, *Submitted to JCP*, 2014.

[4] J.N. Shadid, T.M. Smith, E.C. Cyr, R.P. Pawlowski, and T. Wildey, Stabilized FE Simulation of Prototype Thermal-Hydraulics Problems with Integrated Adjoint-based Capabilities, *Submitted to JCP CASL Special Issue*, 2014.

[5] E.C. Cyr, J.N. Shadid, and T. Wildey, Towards Efficient Backward-in-time Adjoint Computations using Data Compression Techniques, *CMAME*, Vol. 288, 24-44, 2015.

[6] J.H. Chaudhry, E.C. Cyr, K. Liu, T.A. Manteuffel, L.N. Olson, and L. Tang, A Goal-Oriented Approach to Least-Squares Finite Element Methods, *SIAM Journal on Numerical Analysis*, Vol. 52, 3085-3105, 2014.

[7] E.G. Phillips, H.C. Elman, E.C. Cyr, J.N. Shadid, and R.P. Pawlowski, A Block Preconditioner for an Exact Penalty Formulation for Stationary MHD, *SIAM Journal on Scientific Computing*, Vol. 36: B930-B951, 2014.

[8] P. Lin, M. T. Bettencourt, S. P. Domino, T. C. Fisher, M.F. Hoemmen, J. J. Hu, E. T. Phipps, A. Prokopenko, S. Rajamanickam, C. Siefert, E. C. Cyr, S. R. Kennon, Towards extreme-scale simulations with next-generation Trilinos: a low Mach fluid application case study ," Conference Paper, *Workshop on Large-Scale Parallel Processing/28th IEEE International Parallel & Distributed Processing Symposium (IPDPS2014)*, 2014.

[9] E.C. Cyr, J.N. Shadid, and T. Wildey, Approaches for Adjoint-Based a Posteriori Analysis of Stabilized Finite Element Methods, *SIAM Journal on Scientific Computing*, 36:A766-A791, 2014.

[10] E.C. Cyr, J.N. Shadid, R.S. Tuminaro, R.P. Pawlowski, and L. Chacón, A New Approximate Block Factorization Preconditioner for Two Dimensional Incompressible (Reduced) Resistive MHD, *SIAM Journal on Scientific Computing*, 35:B701-B730, 2013.

[11] E.C. Cyr, J.N. Shadid, and R.S. Tuminaro, Stabilization and Scalable Block Preconditioning for the Navier-Stokes Equations, *Journal of Computational Physics*, 231:345-363, 2012.

[12] B. Aksoylu, S.D. Bond, E.C. Cyr, and M. Holst, Goal-Oriented Error Estimation and Multilevel Preconditioning for the Poisson-Boltzmann Equation, *Springer J. Sci. Comp.*, 52:202-225, 2011.

[13] T.M. Smith, J.N. Shadid, R.P. Pawlowski, E.C. Cyr, and P.D. Weber, Reactor Core Sub-Assembly Simulations Using a Stabilized Finite Element Method, *NURETH-14*, 2011.

[14] J.N. Shadid, E.C. Cyr, R.P. Pawlowski, R.S. Tuminaro, L. Chacón, and P.T. Lin, Initial Performance of Fully-Coupled AMG and Approximate Block Factorization Preconditioners for Solution of Implicit FE Resistive MHD, *Proceedings of ECCOMAS-CFD 2010*, http://www.eccomas-cfd2010.org, 2010.

[15] S.D. Bond, J.H. Chaudhry, E.C. Cyr and L.N. Olson, A First-Order Systems Least-Squares Finite Element Method for the Poisson-Boltzmann Equation, *Journal of Computational Chemistry*, 31:1625-1635, 2010.

[16] E.C. Cyr and S.D. Bond, Using the Method of Weighted Residuals to Compute Potentials of Mean Force, *Journal of Computational Physics*, 225:714-729, 2007.

[17] A.A Giunta, L.P. Swiler, S.L. Brown, M.S. Eldred, M.D. Richards, and E.C. Cyr, "The Surfpack Software Library for Surrogate Modeling of Sparse Irregularly Spaced Multidimensional Data," in *Proceedings of the 11th AIAA/ISSMO Multidisciplinary Analysis and Optimization Conference*, AIAA Paper 2006-7049, Portsmouth, VA, 2006.

[18] C.L. Cox, E.C. Cyr, E.B. Duffy, J.B. von Oehsen, and B.A. Malloy, An Efficient C++ Finite Element Viscoelastic Flow Code Exploiting Generative Programming Techniques, *Luxfem 2003 International Conference on Finite element for process*, Luxembourg, Nov. 13-14, 2003.

[19] J.B. von Oehsen, C.L. Cox, E.C. Cyr, and B.A. Malloy, Using Design Patterns and XML to Construct an Extensible Finite Element System, *Proceedings of the International Conference on Computational Science*, Part III, April 21-24, 2002, Lecture Notes in Computer Science, 2331, Springer-Verlag 2002, pp. 735-744.

[20] J.B. von Oehsen, E.C. Cyr, C.L. Cox, and B.A. Malloy, An Internet-Accessible Software Package for Modeling Viscoelastic Flow, *Internet Accessible Mathematical Computation 2002 Workshop*, Lille France, July 7, 2002.

Reports and White Papers

[1] E. C. Cyr, E. Phipps, M. A. Heroux, J. Brown, E. T. Coon, M. Hoemmen, R. C. Kirby, T. V. Kolev, J. C. Sutherland, and C. R. Trott, Algorithms and Abstractions for Assembly in PDE Codes: Workshop Report, *Sandia Technical Report*, SAND2015-1379, February, 2015.

[2] E. C. Cyr and R. P. Pawlowski, Challenges for Component-based Multiphysics PDE Codes on Multicore Architectures, *ASCR Workshop on Software Productivity for Extreme-Scale Science*, January, 2014.

[3] E. C. Cyr, Spatially Varying Embedded Stochastic Galerkin Methods for Steady-State PDEs, *Early Career LDRD Completion Report*, SAND2013-5517, July, 2013.

[4] T. M. Wildey, E. C. Cyr, R. P. Pawlowski, J. N. Shadid, and T. M. Smith, Adjoint Based a posteriori Error Estimation in Drekar::CFD, *CASL 2012-L3 Milestone Report*, SAND2012-8910, October, 2012.

[5] E.G. Philips, E.C. Cyr and J.N. Shadid, An Investigation of Block Preconditioners For Unsteady Navier-Stokes *CSRI Summer Proceedings 2010*, Computer Science Research Institute, Sandia National Laboratories, August 2010.

[6] E.C. Cyr, Numerical Methods for Computing the Free-Energy of Coarse-Grained Molecular Systems, *PhD Thesis*, Department of Computer Science, University of Illinois at Urbana-Champaign, November 2008.

Proceedings Edited

[1] E.C. Cyr and S.S. Collis, editors, *CSRI Summer Proceedings 2010*, Computer Science Research Institute at Sandia National Laboratories, Albuquerque, NM, 2010.

PRESENTATIONS

E. C. Cyr, M. Bettencourt, I. Demeshko and R. P. Pawlowski, Architecture Portable Threaded Assembly for Maxwell's Equations, *SIAM Computational Science and Engineering*, Salt Lake City, Utah, March 15th, 2015 (Invited Poster, Part of "Best Minisymposium").

E. C. Cyr, J. N. Shadid, E. Phillips, R. S. Tuminaro, R. P. Pawlowski, P. T. Lin, L. Chaón, Block Preconditioning for Multi-physics: From Jacobi to Schur Complements, Penn State University, November 10th, 2014 (Invited Presentation).

E. C. Cyr, J. N. Shadid, and D. Kuzmin, Algebraic Linearity Preserving Flux Limiting for Systems of PDEs, *Modeling and Simulation of Transport Phenomena*, Tres-Karden, Germany, July 30th, 2014 (Invited Presentation).

E. C. Cyr, J. N. Shadid, and D. Kuzmin, Algebraic Linearity Preserving Flux Limiting for Systems of PDEs, *World Congress on Computational Mechanics*, Barcelona, Spain, July 23th, 2014 (Invited Presentation).

E. C. Cyr, B. Seefeldt, R. P. Pawlowski, Global Unknown Numbering for Fully-Coupled Mixed Finite Element Methods, *Algorithms and Abstractions for Assembly in PDE Codes* Sandia National Laboratories, Albuquerque, NM, May 12th-14th, 2014 (Invited Poster).

E. C. Cyr, P. T. Lin, R. P. Pawlowski, J. N. Shadid, R. S. Tuminaro, and T. M. Wildey, Towards Scalable and Predictive Computational Solution Methods for Multiphysics PDEs, *Energy and Climate EAB (Sandia Internal)*, Sandia National Laboratories, Livermore, CA, April 30th, 2014 (Invited Poster).

E. C. Cyr, J. N. Shadid, R. P. Pawlowski, A New Split Preconditioner for 3D Magnetohydrodynamics, *Copper Mountain Conference on Iterative Methods*, Copper Mountain, CO, April 8th, 2014 (Invited Presentation).

E. C. Cyr, P. T. Lin, J. N. Shadid, R. P. Pawlowski, Extreme-Scale Preconditioners for Fully-Coupled Magnetohydrodynamics, *DOE Applied Mathematics Meeting*, Albuquerque, NM, August 2013 (Invited Poster).

E. C. Cyr, J. N. Shadid, R. S. Tuminaro, R. P. Pawlowski, L. Chacón, Approximate Block Factorization Preconditioners for 2D and 3D Incompressible MHD, *Coupled Problems 2013*, Santa Eularia, Ibiza, Spain, June 18, 2013 (Invited Presentation).

E. C. Cyr, D. Kuzmin, R. P. Pawlowski, J. N. Shadid, Algebraic Flux Correction FEM for Convection Dominated Transport, *SIAM Conference on Computational Science and Engineering*, Boston, MA, February 28, 2013 (Invited Presentation).

E. C. Cyr, R. P. Pawlowski, D. Ridzal, J. N. Shadid, B. Seefeldt, Finite Element Global Unknown Numbering for Fully-Coupled "Beyond-Nodal" Discretizations, *2012 Trilinos User Group*, Albuquerque, NM, October 30, 2012 (Presentation).

E. C. Cyr, Automated Generation of Spatially Varying Stochastic Expansions for Embedded Uncertainty Quantification, *2012 LDRD Day at Sandia National Laboratories*, Albu-

querque, NM, August 14, 2012 (Poster).

E. C. Cyr, T. Wildey, J. N. Shadid, Goal-oriented a posteriori analysis of stabilized finite element methods, *Modeling and Simulation of Transport Phenomena*, Treis-Karden, Germany, July 30, 2012 (Invited Presentation).

E. C. Cyr, Spatially Varying Stochastic Expansions for Embedded Uncertainty Quantification, 10^{th} *World Congress on Computational Mechanics*, Sao Paulo, Brazil, July 10, 2012 (Invited Presentation).

E. C. Cyr, Spatially Varying Stochastic Expansions for Embedded Uncertainty Quantification, *SIAM Conference on Uncertainty Quantification*, Raleigh, NC, April 2, 2012 (Invited Presentation).

E. C. Cyr, Spatially Varying Stochastic Expansions for Embedded Uncertainty Quantification, *Copper Mountain Conference on Iterative Methods*, March 26, 2012 (Invited Presentation).

E. C. Cyr, R. P. Pawlowski, J. N. Shadid, T. M. Smith, P. D. Weber, T. Wildey, Embedded UQ and QoI/Adjoints in Drekar: New Directions, *CASL TH-M Planning Meeting*, Albuquerque, NM, December 2011 (Presentation).

E. C. Cyr, J. N. Shadid, R. S. Tuminaro, R. P. Pawlowski, P. T. Lin, L. Chacon, A New Approximate Block Factorization Preconditioner for 2D Incompressible Resistive Magnetohydrodynamics, *DOE Applied Mathematics Meeting*, Reston, VA, October 2011 (Invited Presentation).

E. C. Cyr, J. N. Shadid, R. S. Tuminaro, R. P. Pawlowski, L. Chacon, Approximate Block Factorization Preconditioners for Magnetohydrodynamics, 7^{th} *International Congress on Industrial and Applied Mathematics (ICIAM 2011)*, Vancouver, British Columbia, Canada, July 2011 (Invited Presentation).

E. C. Cyr, J. N. Shadid, R. S. Tuminaro, R. P. Pawlowski, L. Chacon, Approximate Block Factorization Preconditioners for Primitive Variable Incompressible Resistive MHD, 16^{th} *International Conference on Finite Elements in Flow Conference (FEF2011)*, Munich, Germany, March 2011 (Invited Presentation).

E. C. Cyr, S. D. Bond, B. Aksoylu, M. J. Holst Goal-Oriented Adaptivity for the Poisson-Boltzmann Equation, *SIAM Conference on Computational Science and Engineering*, Reno, NV, February 2011 (Invited Presentation).

E. C. Cyr, J. N. Shadid, R. S. Tuminaro, Developing Block Preconditioners for Multiphysics Applications Using the Trilinos Package Teko, *DOE Applied Mathematics Program Meeting*, Berkeley, CA, May 4, 2010 (Poster).

E. C. Cyr, J. N. Shadid, R. S. Tuminaro, R. P. Pawlowski, L. Chacon, Approximate Block Factorization and Physics-based Preconditioning: Application to CFD and MHD, *Oak Ridge*

National Laboratories, Oak Ridge, TN, April 27, 2010 (Invited Presentation).

E. C. Cyr, J. N. Shadid, R. S. Tuminaro, R. P. Pawlowski, L. Chacon, Approximate Block Factorization and Physics-based Preconditioning: Application to CFD and MHD, *Copper Mountain Conference on Iterative Methods*, April 8, 2010 (Invited Presentation).

E. C. Cyr, J. N. Shadid, R. S. Tuminaro, R. P. Pawlowski, L. Chacon, Block Preconditioners for Fluid Flow and MHD, *SIAM Conference on Parallel Processing for Scientific Computing*, Seattle, WA, February 26, 2010 (Invited Presentation).

E. C. Cyr, Teko: A Package for Mulitphysics Preconditioners, *Trilinos User Group Meeting*, Albuquerque, NM, November 3, 2009 (Presentation).

E. C. Cyr and S. D. Bond, Goal-Oriented Adaptivity for the Poisson-Boltzmann Equation, *Purdue University, Computational and Applied Mathematics Seminar*, West Lafayette, IN, December 5, 2008 (Invited Presentation).

E. C. Cyr and S. D. Bond, Nonequilibrium Weighted Residual Approximations to the Potential of Mean Force, *BIRS: Mathematical and Numerical Methods for Free Energy Calculations in Molecular Systems*, Banff, AB, Canada, June 16, 2008 (Poster).

E. C. Cyr, Goal-Oriented Adaptivity for the Poisson-Boltzmann Equation, *University of Illinois at Urbana-Champaign CSE Symposium*, Urbana, IL, April 15, 2008 (Invited Presentation).

E. C. Cyr and S. D. Bond, A Comparison of Maximum Likelihood and Weighted Residual Approximations to the Potential of Mean Force, *IMA Summer Program: Classical and Quantum Approaches in Molecular Modeling Engineering*, Minneapolis, MN, July 24, 2007 (Poster).

E. C. Cyr, A Numerical Study of the Regularized Poisson-Boltzmann Equation on Structured Grids, *University of Illinois at Urbana-Champaign CSE Symposium*, Urbana, IL, April 10, 2007 (Invited Presentation).

E. C. Cyr and S. D. Bond, A Comparison of Maximum Likelihood and Weighted Residual Approximations to the Potential of Mean Force, *SIAM Conference on Computational Science and Engineering*, Costa Mesa, CA, February 2007 (Contributed Presentation).

Service

- ◇ Organized Minisympostrium at SIAM Computational Science and Engineering 2015 with Irina Demeshko (SNL)
  Title: *Scalable Finite Element Assembly*
  Winner: Best Minisympostrium Award
- ◇ Organized Mini-symposium at Coupled Problems 2015 with G. Scovazzi (Duke) and J. N. Shadid (SNL)
  Title: *Advanced ALE Methods for Multiphysics Systems*
- ◇ Conceived and organized a SNL workshop titled *Algorithms and Abstractions for Assem-*

bly in PDE Codes with Eric Phipps and Mike Heroux (May 2014)
Keynote speakers: Martin Berzins, Paul Fischer, and Mike Heroux

- ◇ Organized Mini-symposium at SIAM Parallel Processing 2014 with Roger Pawlowski and Eric Phipps (SNL)
  Title: *Large-scale Multiphysics Simulation for Nuclear Reactor Analysis and Design*
- ◇ Organized Mini-symposium at SIAM Parallel Processing 2014 with Eric Phipps and Roger Pawlowski (SNL)
  Title: *Abstractions for Finite Element Assembly on Multi-Core Architectures*
- ◇ Organized Mini-symposium at the 11th World Congress on Computational Mechanics 2014 with Santiago Badia (CIMNE) and John Shadid (SNL)
  Title: *Numerical Approximation of MHD Flows*
- ◇ Organized Mini-symposium at the SIAM Computational Science and Engineering 2013 with Tim Wildey (SNL)
  Title: *Adjoint Methods for Computational PDEs*
- ◇ Organized Mini-symposium at the SIAM Computational Science and Engineering 2013 with Paul Lin (SNL)
  Title: *Block Preconditioners and Physics-based Preconditioners for Large-Scale Multiphysics Simulations*
- ◇ Organized Mini-symposium at the 2012 Copper Mountain Conference on Iterative Methods with John Shadid (SNL)
  Title: *Scalable Preconditioning Methods for Challenging Multiphysics Systems*
- ◇ Organized Mini-symposium at SIAM Parallel Processing 2012 with Aaron Lott (LLNL)
  Title: *Preconditioning Methods for Large Scale Multiphysics Applications*
- ◇ Organized 2010 CSRI Summer Seminar Series
- ◇ Reviewed articles for *Journal of Computational Physics*, *SIAM Journal on Scientific Computing*, *SIAM Journal on Uncertainty Quantification*

Awards

Sandia National Laboratories - *Award For Excellence*

- 2014 Award: "Capability development enabling Drekar to surpass the 32bit barrier for fully-coupled MHD problems."
- 2013 Award: "Exceeding expectations in demonstrating and improving templated Trilinos with SIERRA."
- 2011 Award: "For delivery of advanced CFD capabilities..."
- 2010 Award: "For organizing a CSRI summer student program"

Sandia National Laboratories - *Employee Recognition Award*

- 2015 Nomination: "Completing full 64bit compliant computations in Drekar/Trilinos software to enable near-extreme-scale magnetohydrodynamic simulations of over 10B unknowns and 1/2M cores"
- 2014 Nomination: "ASC Milestone Team: Next Generation HPC Capability for Low Mach Aerodynamics"

CSE Fellow, 2006-2007 and 2007-2008, University of Illinois at Urbana-Champaign
An annual competitive fellowship based on a campus-wide call for interdisciplinary and computationally oriented proposals. (see http://www.cse.illinois.edu/fellows/index.html)

- 2007-2008 Title: *Fast Solutions to the Poisson-Boltzmann Equation Using Hierarchical Basis Functions* (8 selected out of 33)
- 2006-2007 Title: *Multilevel Iterative Methods for Solving the Poisson-Boltzmann Equation*

Outstanding Junior in Computer Science, 2002, Clemson University

Software

Drekar (Spring 2011-present)
This is the finite element program for fluid modeling built on the Panzer library. Currently the physics includes magnetohydrodynamics and fluids. This has been developed by myself, Roger Pawlowski, John Shadid, and Tom Smith of Sandia National Laboratories.

Panzer (Fall 2010-present)
This is a finite element assembly engine using template-based automatic differentiation and embedded types, with a directed acyclic graph for evaluating a user specified physics. This relies heavily on the Trilinos framework, using among other packages, Phalanx, Intrepid, and Epetra. I co-lead this project with Roger Pawlowski.

Teko (Jan 2009-present)
A package for manipulation and (approximate) inversion of block linear systems to accommodate the implementation of block and physics-based preconditioners. Teko is distributed through the Trilinos framework.

Surfpack (Summer 2002)
As an intern at Sandia I completed the initial design and development of Surfpack, a library of surface fitting methods. This package was subsequently matured and incorporated into the DAKOTA framework (see [17]).

Students Mentored

- ◇ Tom Benson - Summer 2012, 2013: Topic area "Vanka Smoothers for Magnetohydrodynamics" (currently graduate student in Math at Tufts)
- ◇ Ben Seefeldt - Summer 2012: Topic area "A Degree of Freedom Manager for Multiphysics Simulation with Performance Analysis" (currently graduate student in CS at UIUC)
- ◇ Edward Phillips - Summers 2010, 2011, 2012: Topic area "Block Preconditioners for MHD" (currently post-doc at Sandia National Laboratories)

Skills

- ◇ Proficiency in C/C++, MATLAB, and Python
- ◇ Experience with Linux, and Mac OS
- ◇ Expertise in the use of the Trilinos framework

References

References available upon request.